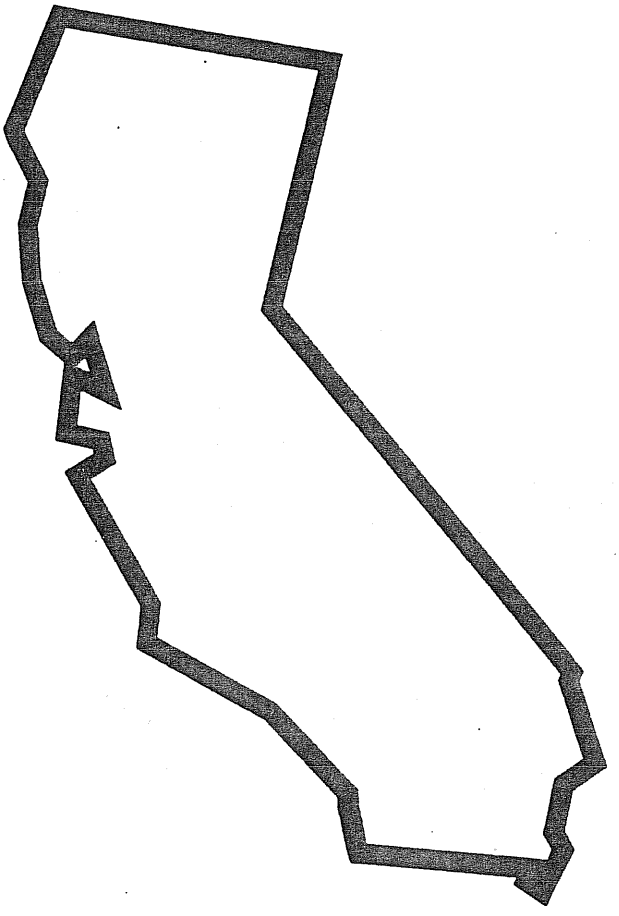
ATTACHMENT 4.

1995 ANNUAL REPORT

CALIFORNIA AGREEMENT IN PRINCIPLE



SEPTEMBER 30, 1995

Table LBNL-1

AIP TLD Monitoring Locations Around LBNL

TLD Monitoring Location Identification	Description of Monitoring Locations
B-13A	WEST OF 88" CYCLOTRON, LBNL
B-13B	NORTHWEST OF BUILDING 90, LBNL
B-13C	PANORAMIC WAY, LBNL
B-13D	NORTH OF 88" CYCLOTRON, LBNL
ENV-75	SOUTH OF BUILDING 75, LBNL
B-13H	SOUTH OF ADVANCED LIGHT SOURCE, LBNL
B-13-6	CONTROL, at DHS, 601 N. 7th, SACRAMENTO

Table LBNL-2

Quarterly Date Ranges That TLDs Were Exposed at Environmental Monitoring Locations Around LBNL - 1995

Quarter	Date TLD placed	Date TLD removed
1	03-JAN-95	03-APR-95
2	03-APR-95	05-JUL-95
3	05-JUL-95	
4		

Table LBNL-3

1995 Gamma Exposure Rates* in (μR/hr) Measured by AIP TLD Monitoring Devices Around LBNL

TLD Monitoring Location Identification	Quarter 1		Quarter 2		Quarter 3		Quarter 4	
	TLD NO.	EXP. RATE μR/hr $\pm$ 2σ	TLD NO.	EXP. RATE μR/hr $\pm$ 2σ	TLD NO.	EXP. RATE μR/hr $\pm$ 2σ	TLD NO.	EXP. RATE μR/hr $\pm$ 2σ
B-13A	51	7.3 $\pm$ 0.4	51	7.8 $\pm$ 0.3	51		51	
B-13A-outside	52	8.0 $\pm$ 0.3	52	7.9 $\pm$ 0.2	52		52	
B-13B	53	6.6 $\pm$ 0.2	53	7.1 $\pm$ 0.2	53		53	
B-13B	54	6.9 $\pm$ 0.2	54	6.8 $\pm$ 0.2	54		54	
B-13C	55	6.8 $\pm$ 0.3	55	7.3 $\pm$ 0.3	55		55	
B-13C	56	6.7 $\pm$ 0.4	56	6.9 $\pm$ 0.5	56		56	
B-13D	57	5.5 $\pm$ 0.2	57	6.3 $\pm$ 0.3	57		57	
B-13D-outside	58	6.4 $\pm$ 0.2	58	6.3 $\pm$ 0.4	58		58	
ENV-75	59	7.1 $\pm$ 0.3	59	7.0 $\pm$ 0.2	59		59	
ENV-75	60	7.3 $\pm$ 0.3	60	7.3 $\pm$ 0.3	60		60	
B-13H	61	6.3 $\pm$ 0.2	61	6.4 $\pm$ 0.3	61		61	
B-13H	62	6.1 $\pm$ 0.2	62	6.3 $\pm$ 0.2	62		62	
B-13-6 Sacramento	63	6.6 $\pm$ 0.2	63	6.8 $\pm$ 0.5	63		63	
B-13-6 Sacramento	64	6.8 $\pm$ 0.2	64	7.2 $\pm$ 0.5	64		64	

* : microroentgens per hr (mR) with 2σ uncertainty estimates

Table LBNL-4

1995 Gamma Exposures* (mR) Measured by AIP TLD Monitoring Devices Around LBNL

TLD Monitoring Location Identification	Quarter 1		Quarter 2		Quarter 3		Quarter 4	
	TLD No.	DOSE mR ± 2σ	TLD No.	DOSE mR ± 2σ	TLD No.	DOSE mR ± 2σ	TLD No.	DOSE mR ± 2σ
B-13A	51	15.9 ± 0.8	51	17.5 ± 0.8	51		51	
B-13A-outside	52	17.3 ± 0.5	52	17.6 ± 0.5	52		52	
B-13B	53	14.3 ± 0.4	53	15.9 ± 0.5	53		53	
B-13B	54	14.9 ± 0.3	54	15.2 ± 0.5	54		54	
B-13C	55	14.7 ± 0.6	55	16.2 ± 0.7	55		55	
B-13C	56	14.6 ± 1.0	56	15.4 ± 1.1	56		56	
B-13D	57	11.9 ± 0.4	57	14.0 ± 0.7	57		57	
B-13D-outside	58	13.8 ± 0.5	58	14.0 ± 0.8	58		58	
ENV-75	59	15.3 ± 0.7	59	15.7 ± 0.4	59		59	
ENV-75	60	15.7 ± 0.7	60	16.2 ± 0.7	60		60	
B-13H	61	13.6 ± 0.4	61	14.4 ± 0.6	61		61	
B-13H	62	13.2 ± 0.5	62	14.3 ± 0.6	62		62	
B-13-6 Sacramento	63	14.4 ± 0.5	63	15.3 ± 1.1	63		63	
B-13-6 Sacramento	64	14.7 ± 0.5	64	16.2 ± 1.1	64		64	

* In milliroentgens (mR) with 2σ uncertainty estimates.

Table LBNL-5

Surface Water Monitoring Locations for LBNL

Creek Name	Sampling Location Description
Blackberry Creek	LeConte and LeRoy Avenue, under Bridge.
Lower Strawberry Creek	Adjacent to the pedestrian walkway at west UC Berkeley entrance.
Upper Strawberry Creek	Footbridge adjacent to the men's and women's faculty clubs (east of campus).
Claremont Creek	North side of Claremont Avenue.
Wildcat Creek	Downstream of duck pond in Tilden Park.

Table LBNL-6a

Comparison of Tritium Levels From Split LBNL Surface Water Samples

(Collection Date: December 15, 1994)

Location	AIP Results (pCi/L)	AIP Duplicate Results (pCi/L)	LBNL Results (pCi/L)
Blackberry Creek	1449 ± 215	1464 ± 215	1200 ± 300
Claremont Creek	< 313	< 313	140 ± 300
Wildcat Creek	< 313	< 313	80 ± 300
Lower Strawberry Creek	440 ± 195	602 ± 199	300 ± 300
Upper Strawberry Creek	< 313	346 ± 193	200 ± 300

Table LBNL-6b

(Collection Date: February 23, 1995)

Location	AIP Results (pCi/L)	AIP Duplicate Results (pCi/L)	LBNL Results (pCi/L)
Blackberry Creek	362 ± 192	322 ± 191	
Claremont Creek	< 310	< 310	
Wildcat Creek	< 313	NS	
Lower Strawberry Creek	< 313	NS	
Upper Strawberry Creek	< 313	<313	

Table LBNL-6c

Collection Date: June 15, 1995

Location	AIP Results (pCi/L)	AIP Duplicate Results (pCi/L)	LBNL Results (pCi/L)
Blackberry Creek	3335 ± 255		
Claremont Creek	< 328		
Wildcat Creek	1147 ± 218	944 ± 214	
Lower Strawberry Creek	5902 ± 294		
Upper Strawberry Creek	< 328	< 328	

Table LBNL-6d

Results of Tritium-Spiked Samples Submitted From the Field

Sample ID #	Date	Known Activity	Reported Activity
R71336	2-23-95	504 pCi/l	593 ± 197 pCi/l
R71334	2-23-95	504 pCi/l	604 ± 197 pCi/l
R71341	2-23-95	0	ND
R71339	2-23-95	2015 pCi/l	2128 ± 202 pCi/l

NOTE: NS = Not Sampled

Table LBNL-7a

Comparison of Gross Alpha, Gross Beta, and Gamma Results from Split LBNL Surface Water Samples

Collection Date: December 15, 1994

Location	Analysis[1]	AIP Results (pCi/L)	AIP Duplicate Results (pCi/L)	LBNL Results (pCi/L)
Blackberry Creek	Gross alpha Gross beta gamma spc. (K-40)	< 2.7 < 12 < 75	< 2.5 < 11.9 < 88	2 ± 1 4 ± 2 < 1*
Claremont Creek	Gross alpha Gross beta gamma spc. (K-40)	< 2.6 < 12 < 82	< 1.5 < 6 < 39	0.2 ± 1 1 ± 2 < 1*
Wildcat Creek	Gross alpha Gross beta gamma spc. (K-40)	< 2.6 < 12 52.2 ± 84.3	< 1.3 < 6 < 39	2 ± 1 2 ± 2 < 1*
Lower Strawberry Creek	Gross alpha Gross beta gamma spc. (K-40)	< 1.3 < 6 < 66	< 1.3 < 6.4 < 39	0.8 ± 1 3 ± 3 < 1*
Upper Strawberry Creek	Gross alpha Gross beta gamma spc. (K-40)	< 2.6 < 12 < 67	< 2.8 < 12 < 36	0.7 ± 1 3 ± 3 < 1*

* MDA (minimal detectable activity) from 50 to 2,000 keV.

Table LBNL-7b
Comparison of Gross Alpha, Gross Beta, and Gamma Results from Split LBNL Surface Water Samples
Collection Date: February 23, 1995

Location	Analysis[1]	AIP Results (pCi/L)	AIP Duplicate Results (pCi/L)	LBNL Results (pCi/L)
Blackberry Creek	Gross alpha Gross beta gamma spc. (K-40)	0.9 ± 0.8 < 4.4 < 74	1.13 ± 0.7 < 2.7 < 56	
Claremont Creek	Gross alpha Gross beta gamma spc. (K-40)	< 1.1 < 6.5 < 42	< 1.1 < 6.5 < 71	
Wildcat Creek	Gross alpha Gross beta gamma spc. (K-40)	< 0.5 < 2.6 < 40	< 0.5 < 2.6 < 74	
Lower Strawberry Creek	Gross alpha Gross beta gamma spc. (K-40)	0.6 ± 0.5 < 2.6 < 82	< 0.6 < 2.6 < 75	
Upper Strawberry Creek	Gross alpha Gross beta gamma spc. (K-40)	< 0.8 5.88 ± 2.49 < 80	< 1.1 < 6.5 < 80	

Table LBNL-7c
Comparison of Gross Alpha, Gross Beta, and Gamma Results from Split LBNL Surface Water Samples (continued)
Collection Date: June 15, 1995

Location	Analysis[1]	AIP Results (pCi/L)	AIP Duplicate Results (pCi/L)	LBNL Results (pCi/L)
Blackberry Creek	Gross alpha Gross beta	< 0.66 < 4.0	NS NS	
Claremont Creek	Gross alpha Gross beta	< 2.1 12.5 ± 6.5	NS NS	
Wildcat Creek	Gross alpha Gross beta [2]	< 2.0 11.9 ± 6.4	< 1.9 87.3 ± 10.7[2]	
Lower Strawberry Creek	Gross alpha Gross beta	< .56 7.59 ± 1.92	NS NS	
Upper Strawberry Creek	Gross alpha Gross beta	< 1.9 < 10	< 2.2 15.8 ± 6.7	

1 Samples analyzed for gross alpha and gross beta using EPA Method 900.0. Samples analyzed for gamma emitters using EPA Method 901.1. Both methods from Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-8-032, August 1980.

2 Shading indicates gross beta result that is at variance with validation criterion. These results of duplicates do not agree; SRLB has been asked to reanalyze if there is sufficient sample for reanalysis.

Table LBNL-8

Results of Metals Analysis from LBNL Surface Water Samples

Collection Date: February 23, 1995

	Arsenic (As) MCL = 50	Cadmium (Cd) MCL = 10	Chromium (Cr) MCL = 50	Selenium (Se) MCL = 10
Blackberry Creek	< 6	< 6	< 5	< 10
	< 6	< 6	< 5	< 10
Claremont Creek	< 6	< 6	< 5	< 10
	< 6	< 6	< 5	< 10
Wildcat Creek	< 6	< 6	< 5	< 10
	< 6	< 6	< 5	< 10
Lower Strawberry Creek	< 6	< 6	< 5	< 10
	< 6	< 6	< 5	< 10
Upper Strawberry Creek	< 6	< 6	< 5	< 10
	< 6	< 6	< 5	< 10
X-1 STW3	< 6	< 6	< 5	< 10
	< 6	< 6	< 5	< 10

NOTE: reporting units are micrograms per liter (μg/L)

Table LBNL-9

Comparison Sampling for VOCs in Groundwater at LBNL

DATE	WELL #	ANALYTE [1]	RESULTS (ppb) DL = .5 [2]	
			LBL	AIP
5/11/95	53-93-16 (42)	cis 1,2-dce	8.9	6.6
		pce	36	50.6
		tce	11	15.7
		trans 1,2 dce	nd	.8
	53-93-16 (69)	carbon tetra	45	25
		chloroform	16	13.6
		1,1 dca	nd	4.1
		1,1 dce	32	23.3
		cis 1,2-dce	51	36.9
		trans 1,2-dce	nd	6.1
		pce	520	705
		1,1,1-tca	nd	2.2
		tce	210	298
	53-92-21 (130)	pce	0.64	.7
		tce	nd	.5
	53-93-21 (147, 164)	vocs	nd	nd
	53-93-21 (193)	benzene	nd	.7
	cd-92-28	vocs	nd	nd
6-7-95	71-94-1	chloroform	2	31.8
		pce	1.0	1.0
		toluene	1.0	1.1
		1,1,1,-tca	.73	.7
		tce	1.6	1.8
		freon 113	210	130 [3]
		bromodichloro	nd	2.1
	71-93-1	chloroform	nd	.9
		1,1-dce	4.5	5.4

6-7-95	71-93-1	pce	1.0	0.7
		1.1.1-tca	4.9	5.3
		tce	.52	.8
		benzene	nd	.6

1. VOC constituents not listed were not detected by either laboratory. LBNL used EPA Method 8260. AIP Program samples collected May 11, 1995 were analyzed by the Regional Water Quality Control Board, Central Valley Region Laboratory using a modified EPA Method 601/602. AIP Program samples collected on June 6, 1995 were analyzed by California Sanitation & Radiation Laboratory in Berkeley using EPA method 601/602.

2. DL = Detection Limit

3. Tentative identification by NIST library search with an estimated concentration calculated by using ratio of areas from total ion chromatograms with the internal standard fluorobenzene.

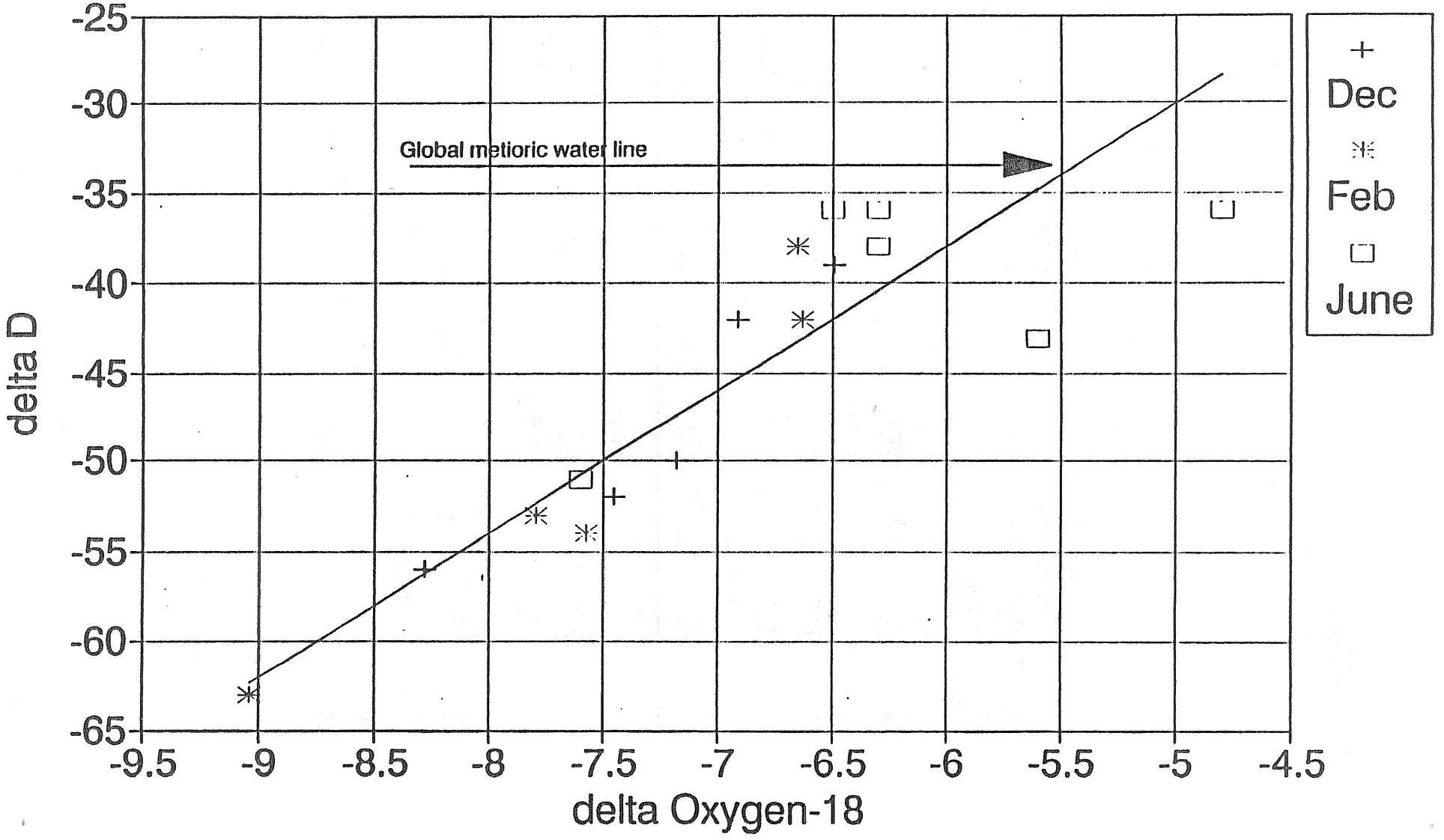
Table LBNL-10

Stable Isotope Results (Oxygen and Hydrogen) for Surface Water Samples collected at LBNL

DATE SAMPLED	SAMPLE LOCATION	OXYGEN	HYDROGEN
15-Dec-94	BLACKBERRY	-7.45	-52
23-Feb-95	BLACKBERRY	-7.79	-53
15-Jun-95	BLACKBERRY	-4.8	-36
15-Dec-94	CLAREMONT	-6.91	-42
23-Feb-95	CLAREMONT	-6.63	-42
15-Jun-95	CLAREMONT	-6.5	-36
15-Dec-94	L. STRAWBERRY	-8.28	-56
23-Feb-95	L. STRAWBERRY	-9.04	-63
15-Jun-95	L. STRAWBERRY	-5.6	-43
15-Dec-94	U. STRAWBERRY	-7.18	-50
23-Feb-95	U. STRAWBERRY	-7.57	-54
15-Jun-95	U. STRAWBERRY	-7.6	-51
15-Dec-94	WILDCAT	-6.49	-39
23-Feb-95	WILDCAT	-6.65	-38
15-Jun-95	WILDCAT	-6.3, -6.3	-38
15-Jun-95	WILDCAT	-6.3	-36
15-Jun-95	QA/QC - BLANK	-10.2	-71, -73

Stable Isotope Values in Surface Water

at LBNL Dec'94, Feb '95, & june '95



Oxygen Stable Isotope Ratios at LBNL Groundwaters (‰ vs SMOV)

Oxygen stable isotope ratios in wells investigated by AIP and reported previous to the AIP 1995 investigation

	LBNL Reported Data							AIP Collected Data		
WELL ID	7/92	12/92	1/93	2/93	3/93	6/93	11/93	3/94	May	&Jun/1995
6-92-17	*	-9.5	*	*	-9.6	-9.6	-9.1	-8.9	-8.8	-58
7-92-16	*	-8.1	*	*	*	-8.3	-8.3	-8.2	-8.5	-55
62-92-27	*	-7.6	*	*	-8.1	-8.1	-8.3	-8.4	-8.2	-48
70-92-7	-8.0	*	*	-7.8	-8.2	-8.3		-8.0	-7.9	-51
MWP-7	-5.0	*	*	-7.3	*	-7.3	-6.9		-7.8	-50
46A-92-15	*	-7.6	*	*	-7.8	-7.8	-7.6	-7.7	-7.5	-49
MW62-B1A	*	*	*	*	-8.0	-7.8		-4.9	-7.4	-47
MW62-B2	-8.4	*	*	-8.1	-8.3	-8.1		-7.9	-7.4	-50
MWP-8	-7.5	*	-7.2	*	*	-7.5	-7.3	-7.3	-7.4	-50
37-92-6	-7.3	-7.3	*	-7.0	-6.9	-7.3	-7.4	-7.3	-7.3	-45
MW76-1	-7.3	*	-7.4	*	-7.5	-7.4	-7.2	-7.4	-7.3	-46
MW90-2	-7.5	*	-7.4	*	*	-7.4	-7.3	-7.5	-7.2	-43
88-92-4	-7.8	*	*	-7.6	-7.7	-7.5	-6.9	-7.2	-7.1	-43
MWP-6	*	*	-6.8	*	*	-7.4	-7.1	-7.1	-7.1	-43
MW90-4	-7.1	*	-7.2	*	-7.0	-6.7	-7.1	-6.9	-7.0	-43
MWP-1	-7.0	*	*	-6.7	-7.2	-7.3	-6.6	-6.7	-6.9	-48
7-92-19	*	-6.9	*	*	*	-6.9		-6.6	-6.9	-48
MW91-7	-6.6	*	*	-6.6	*	-6.8	-6.7	-6.7	-6.7	-42
MW90-3	-6.5	*	*	-6.5	-6.8	-7.0	-6.7	-6.5	-6.7	-38
75B-92-24	*	-5.8	*	*	-6.4	-6.6	-6.3	-7.1	-6.6	-45
MWP-9	-6.3	*	*	-5.6	*	-6.7	-6.3	-6.5	-6.5	-39
MWP-2	-6.4	*	*	-6.4	*	-6.5		-6.6	-6.5	-36
26-92-11	-6.4	*	-6.4	*	-6.4	-6.8	-6.3	-6.5	-6.4	-43
MW1-220	-6.1	*	*	-6.0	*	-6.1	-6.0	-6.2	-6.3	-36
MW91-8	-6.7	*	*	-7.4	*	-6.4	-6.7	-11.8	-6.3	-41
MW91-4	-7.0	*	-8.1	*	-7.6	-7.2	-6.9		-6.3	-48
46-92-9	*	-6.1	*	-6.2	-7.7	-6.0	-6.3	-6.3	-6.3	-40

TABLE-AIP-SEP95

Oxygen Stable Isotope Ratios at LBNL Groundwaters (‰ vs SMOV)

Oxygen stable isotope ratios in wells investigated by AIP and reported previous to the AIP 1995 investigation

	LBNL Reported Data							AIP Collected Data		
WELL ID	7/92	12/92	1/93	2/93	3/93	6/93	11/93	3/94	May &Jun/1995	
62-92-26	*	-6.2	*	*	-6.2	-6.5		-6.3	-6.3	-45
74-92-13	-6.1	*	-6.2	*	-6.0	-6.3		-6.4	-6.2	-34
27-92-20	*	*	-6.3	*	*	-6.2	-6.2	-11.4	-6.2	-38
76-92-25	*	-6.0	*	*	-6.2	-6.3	-6.0	-5.9	-6.2	-35
83-92-14	-7.1	*	-7.0	*	-6.5	-6.4	-6.3	-6.1	-6.2	-41
77-92-10	-5.8	-6.6	-6.1	*	-6.3	-6.2	-5.9	-6.2	-6.1	-34
MW91-1	-6.1	*	*	-5.9	*	-6.2	-6.2		-6.1	-37
51-92-2	-5.7	*	*	-5.9	-6.4	-6.2			-6.1	-31
MWP-4	-6.0	*	*	-6.0	*	-6.2	-6.2	-6.1	-6.1	-40
MWP-5	*	*	*	-6.0	*	-6.0	-6.0	-6.0	-6.1	-36
CD-92-28	*	*	-5.9	*	-7.2	-6.1		-5.9	-6.0	-37
61-92-12	-6.0	*	-6.0	*	-6.2	-6.1	-6.1	-6.0	-6.0	-39
37-92-18A	*	-5.9	*	*	-6.0	-6.3	-5.8	-5.7	-5.8	-40
MWP-10	-5.8		-5.7			*	-5.8	-5.8	-5.8	-33
MW7-1	*	*	-6.6	*	*	*		-6.5	-5.7	-33
MW91-9	-8.0	*	*	-7.8	-8.3	-8.2	-7.4	-7.5		
MW91-2	-6.8	*	*	-6.8	-7.2	-7.2	-7.1	-7.1		
75-92-23	*	-6.6	*	*	-6.7	-6.7	-6.4	-6.5		
58-92-8	-6.2	*	*	-6.2	-6.5	-6.6				
MW90-5	-6.5	*	-6.4	*	-6.3	-6.6	-6.4			
MW90-6**	-6.4	*	-6.4	*	-6.3	-6.4	-6.5	-6.3		
37-92-18	*	-5.8	*	*	-6.0	-7.6	-6.4	-6.2		
37-92-5	-5.7	*	*	-5.6	-6.0	-5.8	-5.6	-5.9		
MW91-3	-5.9	*	-5.9	*	*	-6.1	-5.8	-5.9		
MW91-5	-6.7	*	-6.5	*	*	-6.5	-6.3	-6.3		
MW91-6	-7.2	*	-7.1	*	*	-7.3	-7.2	-7.2		

TABLE-AIP-SEP95

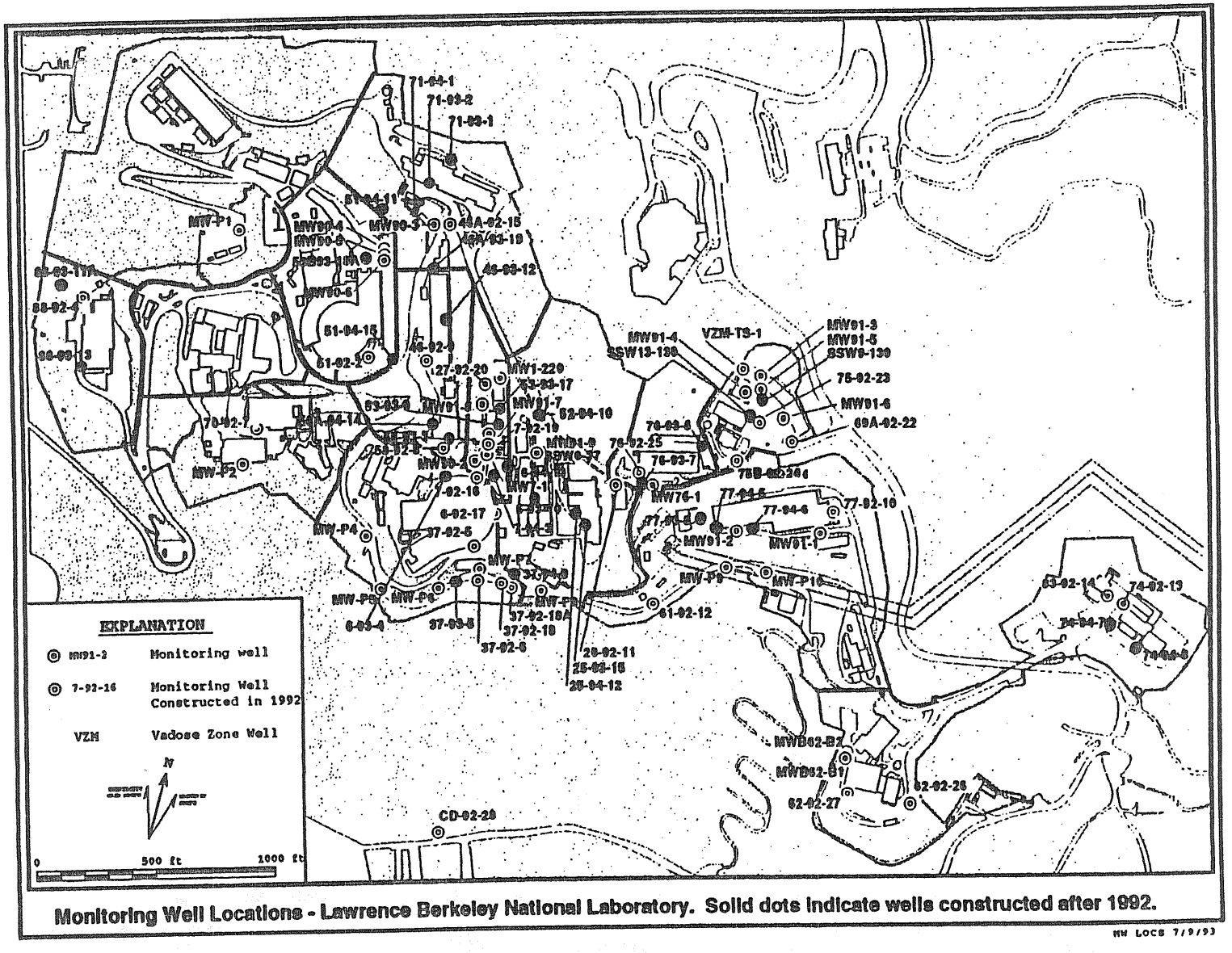
Oxygen Stable Isotope Ratios at LBNL Groundwaters (‰ vs SMOV)

Wells sampled by AIP in 1995 for which no data had previously been obtained at LBNL

AIP

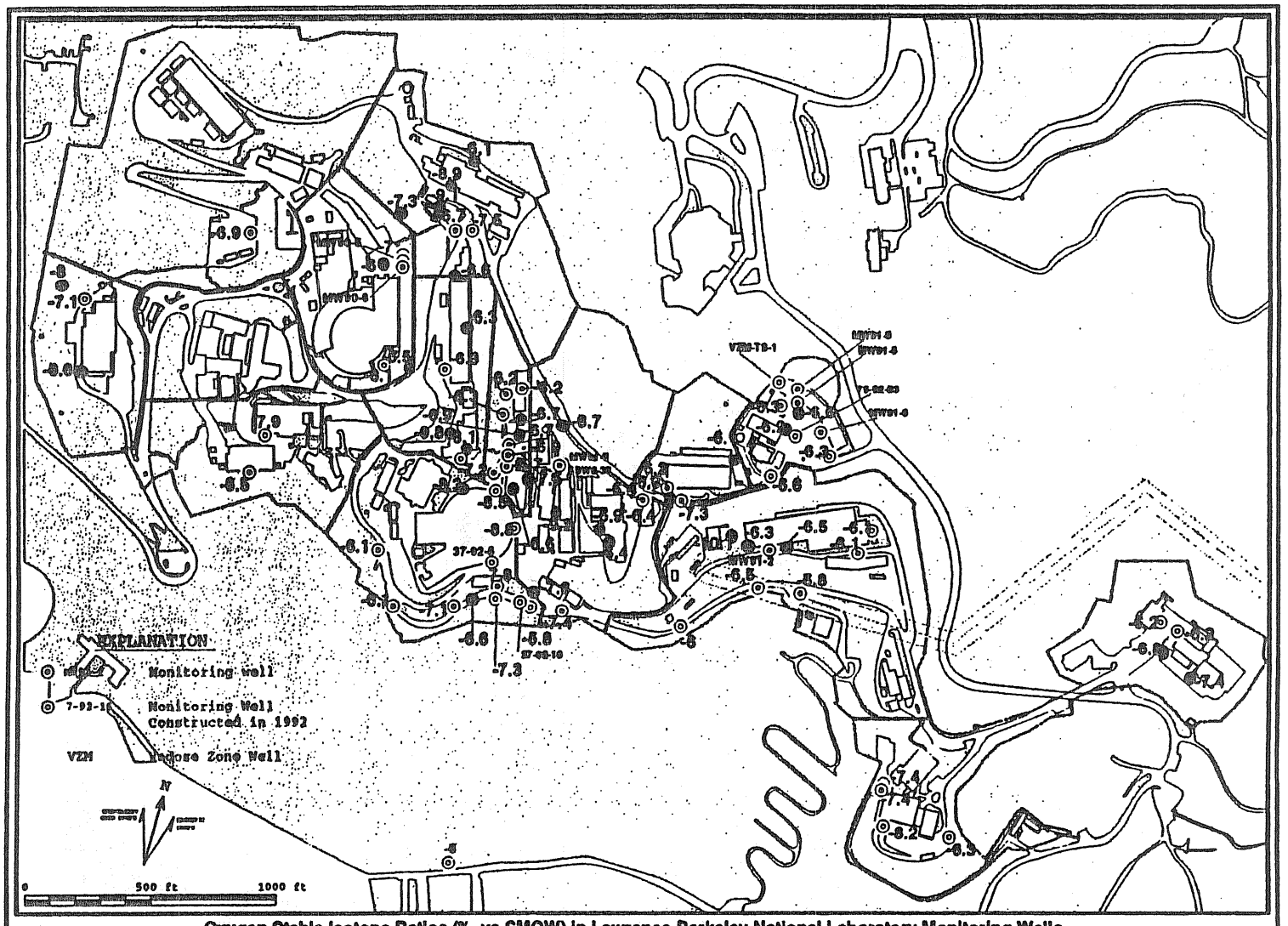
May &Jun/1995

16-94-13	-7.45	-49
37-93-5	-6.6	-43
37-94-9	-7.29	-48
46A-93-19	-6.59	-50
5-93-10	-9.19	-64
53-92-21 (130)	-7.1	-48
53-92-21 (147)	-8	-55
53-92-21 (167)	-7.4	-47
53-92-21 (193)	-8	-52
53-93-16 (42)	-6.4	-38
53-93-16 (69)	-6.8	-41
53-93-9	-6.86	-38
71-94-1	-9.05	-66
71-95-1	-6.64	-44
71-95-8	-6.34	-34
71-95-9	-7.15	-38
74-94-7	-6.75	-36
77-93-8	-10.1	-66
77-94-5	-6.34	-39
77-94-6	-6.48	-42
OW-3-225	-6.08	-44



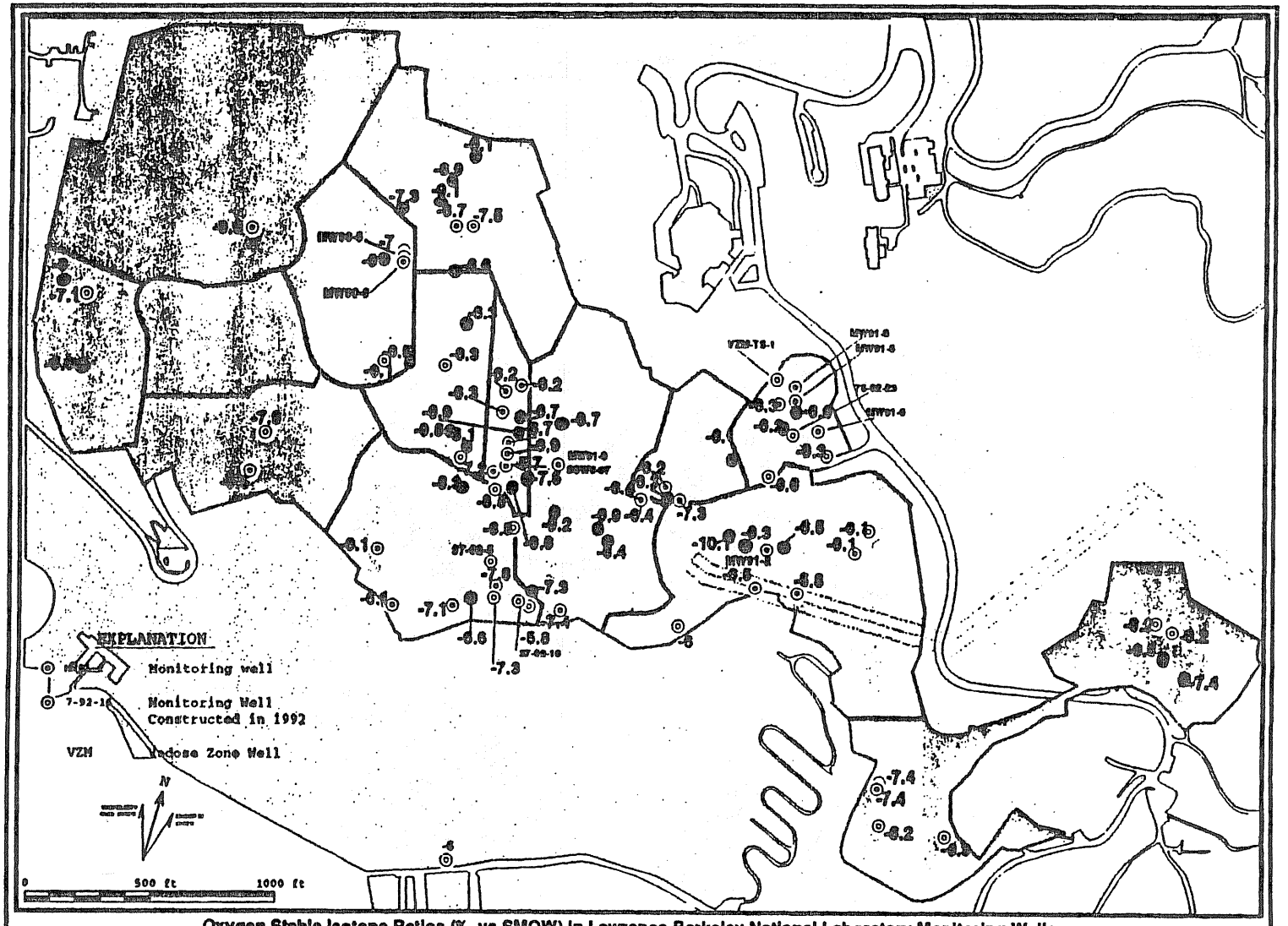
Monitoring Well Locations - Lawrence Berkeley National Laboratory. Solid dots indicate wells constructed after 1992.

MW LOCS 7/9/93



Oxygen Stable Isotope Ratios (‰ vs SMOW) in Lawrence Berkeley National Laboratory Monitoring Wells
Sampled by the AIP Program in May and June, 1995

NW LOCS 7/9/93

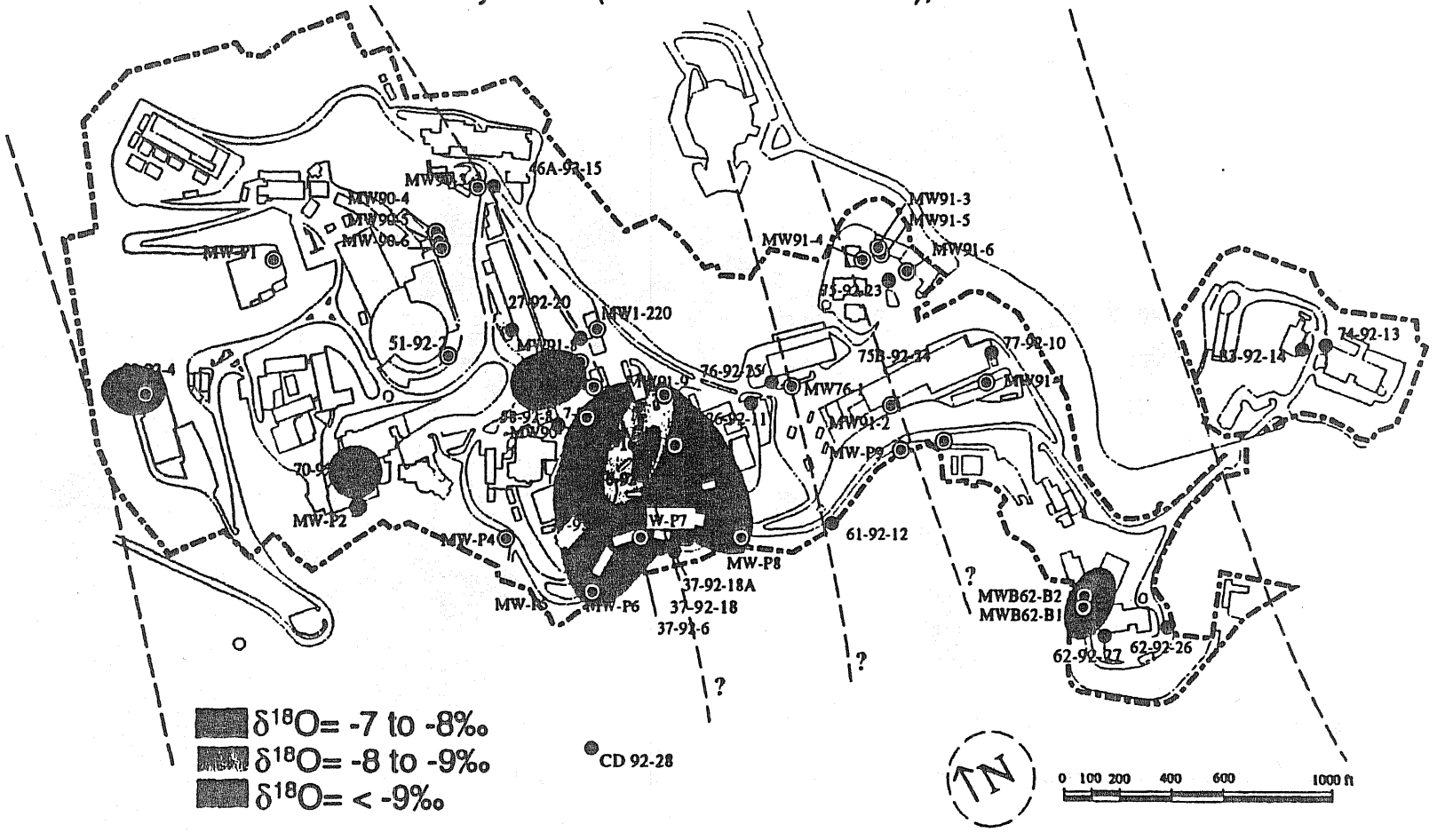


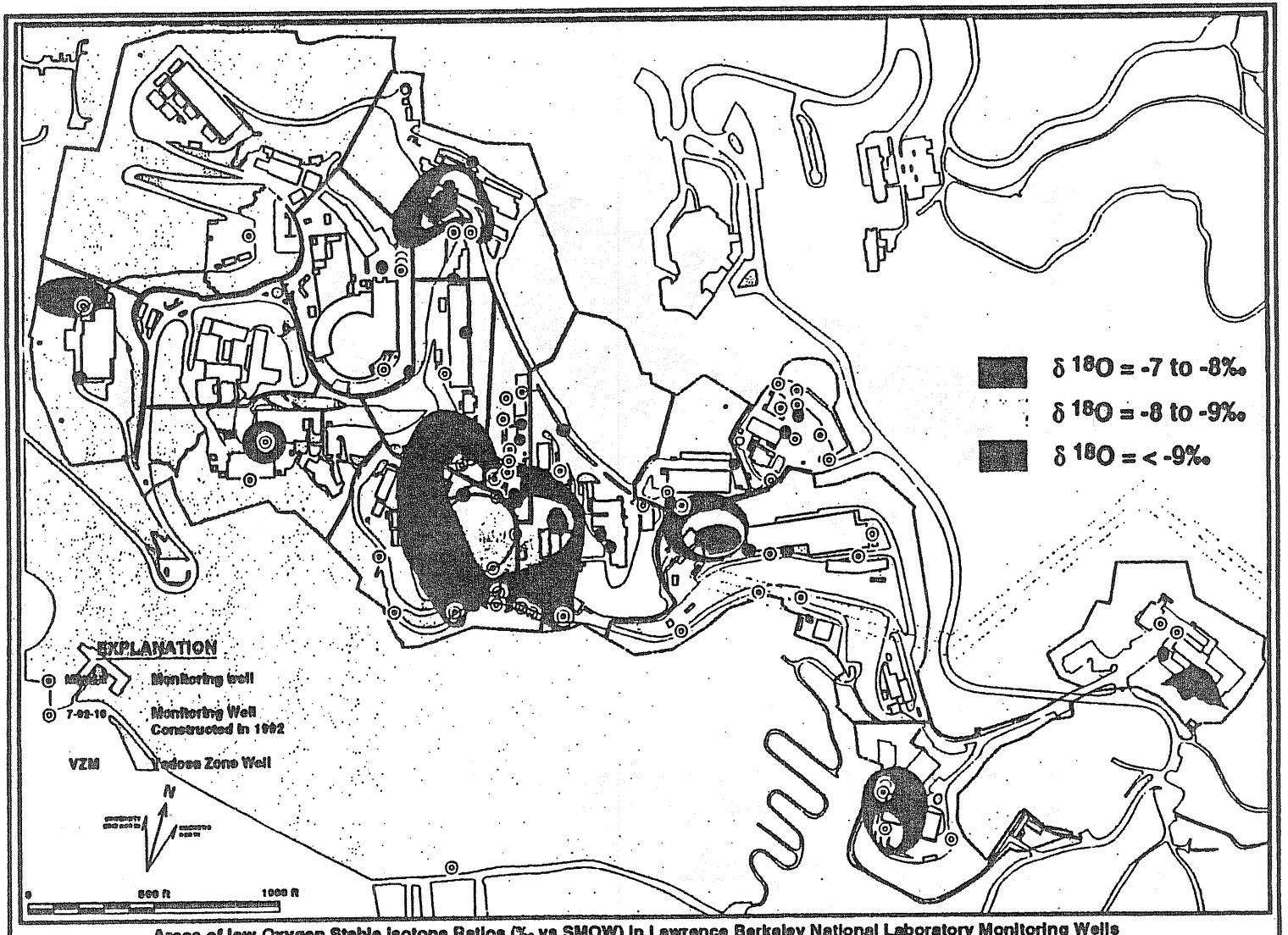
Oxygen Stable Isotope Ratios (‰ vs SMOW) in Lawrence Berkeley National Laboratory Monitoring Wells
Sampled by the AIP Program in May and June, 1995. Solid dots indicate wells not previously sampled for stable isotope analysis.

MW LOCS 7/9/93

Spatial Variability of Oxygen Isotope Ratios in LBNL Groundwaters

Areas of possible contamination of groundwater ($\delta^{18}O$= -6 to -7‰) with facility water (EBMUD $\delta^{18}O$= -13‰), FY1992-93





Areas of low Oxygen Stable Isotope Ratios (‰ vs SMOW) in Lawrence Berkeley National Laboratory Monitoring Wells
Wells Sampled by the AIP Program in May and June, 1995

MW LOCS 7/803